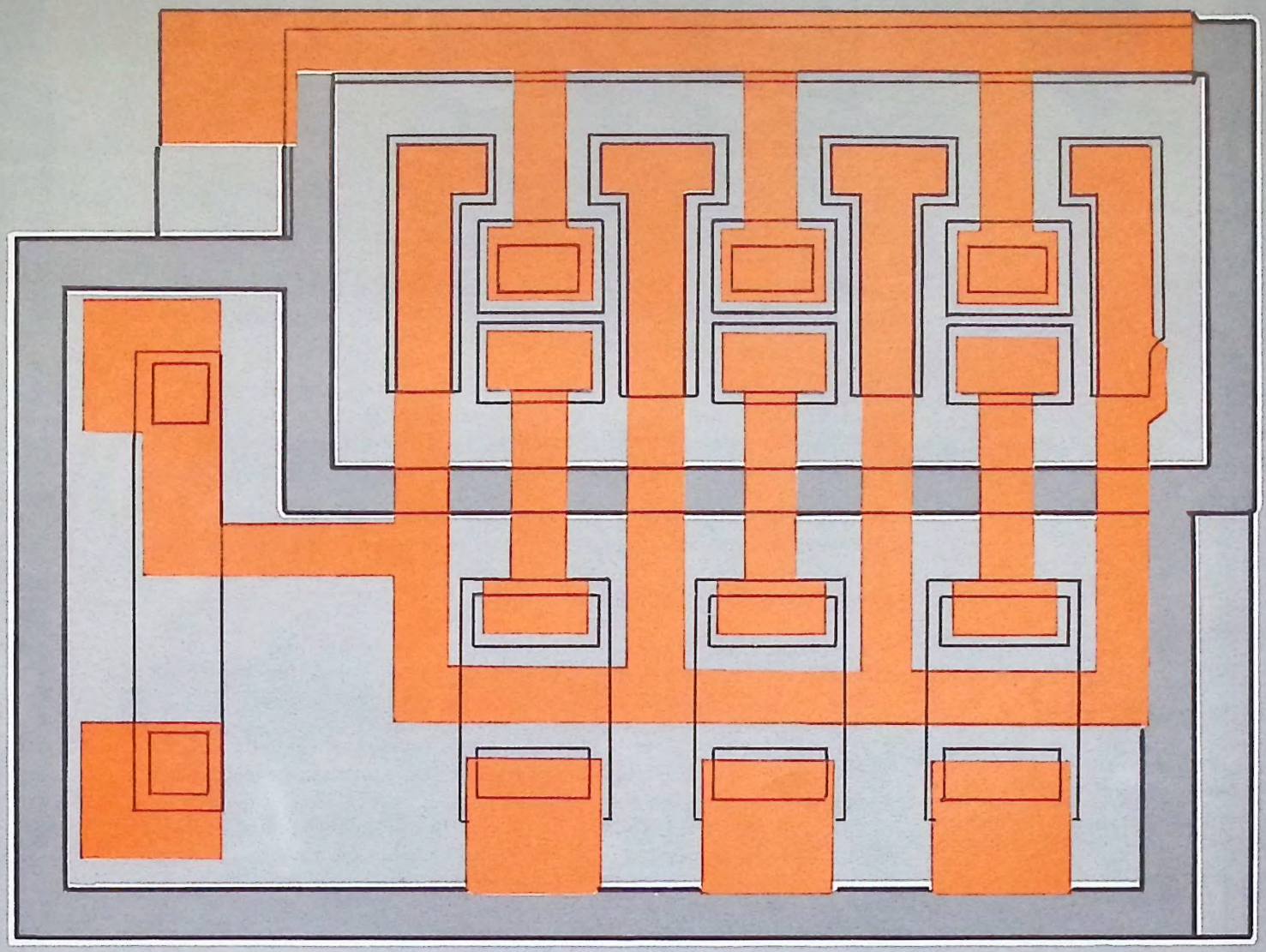


ROGERS BOOSTER

SPRING — 1963

EDITORIAL

These days, when everybody's suspicious of everybody else, you only have to issue a publication like the Booster for people to start asking why.

Well, we've answered the question before and we'll answer it again now. *We don't have an axe to grind.* All that's in it for us is a share of the electronics business—and electronics is the business we're in together.

So we're not subservient to any given organization, and not interested in pushing this one more than the next. All we *do* say is—for their own good, and to protect the public, TV technicians should get organized one way or another—and soon!

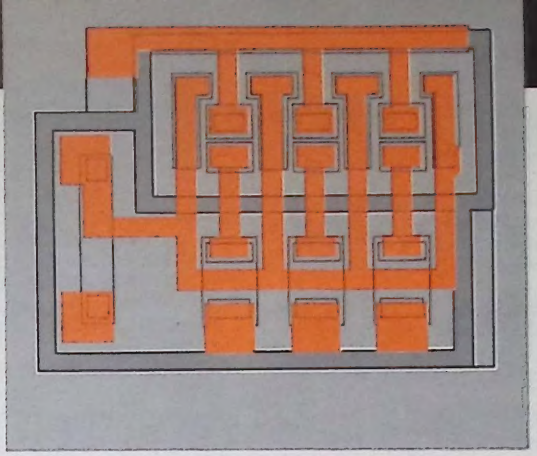
We're all concerned about the kind of image TV technicians build for themselves. If the public get the wrong impression of of repair men in general, or only call up the serviceman when their nerves are already jangling, everybody suffers.

Elsewhere in this issue a special feature on the need to keep up with new developments and techniques, highlights another aspect of the same problem. Building up and retaining the right image involves more than just speedy service and moderate prices. More and more it's going to mean mastering whole new areas of theory, absorbing masses of new detail. And Mr. and Mrs. Jones expect us to take all this in our stride.

They want to be able to call up . . . have a repair man there in minutes . . . have the trouble diagnosed and put right in a few minutes more. And they don't want excessive charges, or any lame excuses about the new sets being trickier to fix than the old.

Two facts we can be certain about. Big new things are happening in the fields of science and research. And the overall domestic TV market involves huge amounts of money. Where the spoils are big enough you can have any number of victors. So the changes in design and circuit and performance characteristics are likely to continue for years.

That means the TV technician's problems will continue too. But the basic one, keeping up with the changes, is really no problem at all. There are scores of books, and many different evening and correspondence courses. And there's year after year of profit and enjoyment for the technicians who have what it takes.



Solid state integrated circuitry — the military development with great commercial potential.

Back to the books!

Service technicians must study to keep up with design engineers

People in the electronics industry have a serious problem. The technology is advancing so rapidly the workers in it can't keep up-to-date. It has been estimated that the average engineer is obsolete eight or ten years after graduation.

If this can happen to the people who are helping to push back the frontiers of the technology, it can also happen to people farther back along the chain—the service technicians.

Radio and television receivers, record changers and tape recorders are in a continuous process of evolution. Some changes reduce servicing problems and some increase them. But every change demands study and upgrading of the service technician.

Here are some of the changes that have taken place in the Canadian industry since World War II.

HOW IT ALL STARTED

There weren't many TV sets around during the war, but a fair number of technicians picked up valuable experience servicing radar sets in the Navy, Army and Air Force. It wasn't too hard for them to learn the new servicing techniques when TV finally moved into Canada in the early 1950's.

Since then there has been steady progress in circuit design as component manufacturers have introduced new tubes, coils, capacitors, tuners, and other active and passive elements.

Printed circuit boards had a stormy entry into the industry when service technicians, complete with Faithful old 10-lb, 150-watt soldering irons blazed a wide trail across the new phenolic frontier. But a little training, a little patience, and small soldering irons have almost completed the changeover. And now that manufacturers are printing part numbers on the boards, fewer technicians are getting lost.

TAPE RECORDERS AND RECORD CHANGERS

The tape recorder is another piece of equipment that has entered the home entertainment field since World War II. With it came some difficult mechanical servicing problems that the electronics men were not equipped to handle. Some acquired the skill, but even today the average electronics serviceman is doing his customer a real favor by taking the tape deck to a specialist shop for mechanical repair.

The same applies to record changers. They were complicated enough back in the days when 78 rpm ruled supreme, but adding 33 and 45 almost made it necessary to recruit watch repairmen into the electronics industry. Then, of course, someone added 16 rpm just for good measure.

STEREO RECORDS

By 1958 the industry was looking for new ideas to increase its sales of consumer products. It found a good one—the stereo record.

Back to the books once more for the service technician. It wasn't a simple case of having twice as much equipment to check. He had to learn a bit more about ground loop hum (then ignore the rules because the hum does), intermodulation, speaker phasing and tricky switching circuits.

If he managed to keep up with that development the next one, FM multiplex stereo, wasn't quite so high a hurdle.

continued over

THE TRANSISTOR

Back in 1948 two scientists at Bell Telephone Laboratories developed a little component that will be with us in one form or another for many, many years. It's the transistor.

These amazing little semiconductor devices will work away month after month, bouncing happily along in school bags and bicycle carriers, but just try bringing a soldering iron within an inch of one—ppffzzt!

Back to the books once more. Service technicians are going to see a lot more of transistors within the next two or three years, and they will be in the high-quality radios and television sets.

SETS WITHOUT TRANSFORMERS

But before looking into the crystal ball there is one change taking place today that should be mentioned. It's the gradual disappearance of the power transformer. And with it goes the serviceman's faithful old technique of looking to see which tubes are dead.

With a quick side step to avoid an argument over the virtues of transformers, a check of new sets on the market shows a decline in the use of them, even in the top line TV receivers. Some dealers, possibly supported by their service departments, still foster the idea that sets with transformers are of higher quality and reliability than their lighter rivals. This is no longer true.

The service technician who has learned to handle the transformerless TV and radio receivers, and who has acquired the proper instruments, is well along the road to successful servicing of transistor sets.

Now a quick look in the crystal ball for some piezoelectric prognostications.

COLOR TV

Color television sets won't reach any volume in Canada until the Board of Broadcast Governors permits telecasting. When the Governors held their last hearing on the subject a few months ago they made it quite clear that they aren't ready to give their consent for some time—possibly two or three years.

By then there may be some major technological advances in components, particularly the picture tube, or its solid state counterpart. Bits of information leaking out from various companies, indicate many of them are working on a simple replacement for the present three-gun, shadow mask type color tube. Some developments appear close to success, but that isn't good enough. However, watch this field closely; it will affect the service technicians' work in a few years.

TRANSISTOR TV

Transistors will move into TV receivers—and it may take place with the 1964 models. Canadian manfacturers are caught between the price advantage of tubes, and the glamour of transistors (plus reduced power consumption.) Hybridization is the logical first step, with transistors moving into some, but not all, of the circuit functions in the receivers.

This has economic advantages for both manufacturers and service technicians. It lets them become progressively familiar with the techniques and problems.

The April 1963 issue of The Emitter, issued by Philips Electron Devices Ltd., starts a series devoted to this subject. Any section of a TV receiver, with the exception of power stages, is suitable for transistors. Sections under examination by Philips Application Laboratory include a video IF strip, sound IF strips, and a horizontal oscillator.

The Emitter shows the circuit for a complete sync. separator, phase detector and horizontal oscillator using one tube and one low-cost transistor, plus diodes. It could be the type of circuit service technicians will run into before the end of the year.

RADIATION RESTRICTIONS

The Department of Transport has just issued a notice to manufacturers of television receivers that new regulations limiting the amount of RF radiation from horizontal oscillator circuits will go into effect in a few months. The previous limit of 100 microvolts will be reduced to 10 microvolts.

Such a regulation has little meaning if service technicians do not know about it, and avoid disturbing the shielding built into the receiver.

Engineers and scientists working on high-reliability military and space electronic equipment are introducing some interesting components and production techniques that may eventually find their way into consumer products. In their work, space, weight and reliability are more important than cost. When you change the emphasis for consumer products cost becomes a major consideration, with reliability, space and weight moving down the scale accordingly.

This change of emphasis will keep some sophisticated developments out of the consumer equipment, but here are a few things that may make the grade.

MODULAR CONSTRUCTION

The use of long-life transistors will permit manufacturers to design some circuits, or groups of circuits into modules. This opens the possibility of some manufacturer, perhaps a component manufacturer, producing a series of standard modules that receiver designers would incorporate in their sets. On this basis, the modules could be produced in volume at low cost, premitting replacement of the entire module in the event of failure.

Repair would not be practical if the commercial modules follow the present trend of their military cousins. The components are welded together, rather than soldered, and the modules are encapsulated to protect them against vibration, shock, heat, moisture and other environmental conditions.

Welding is already used in production of transistors and silicon rectifiers, so it wouldn't be any problem adapting it to other steps in the production of television and radio receivers. It isn't used today because of higher cost without adding any mechanical advantages over wave soldering techniques. And imagine the problems it could produce for the service technician.

SEMICONDUCTOR INTEGRATED CIRCUITS

One step beyond modules lie semiconductor integrated circuits. They are complete circuit functions, produced as a single semiconductor device through a complicated process of masking, etching, diffusing and plating.

During the past year most of the major semiconductor manufacturers have offered for sale a variety of integrated circuits. Most of the commercial versions are intended for use in computers, control equipment, specialized instruments and similar equipment, where space and reliability are important.

These new components will not be used extensively in home entertainment equipment as long as the present-day picture tube and loudspeaker exist. But as soon as some engineer comes up with a truly-flat picture tube, and a miniature producer of high fidelity sound, there will be a real incentive to adopt integrated circuits.

NEW PRICE OF SURVIVAL

What does all this crystal ball forecasting mean to the service technician?

One lesson stands out. Servicemen will have to do a lot of studying if they want to keep up with the changes in equipment. They will also have to invest in new types of test instruments.

During the past few years there has been a steady change in servicing conditions that create valid reasons for manufacturers setting up repair depots. But manufacturers recognize the value of independent service technicians and prefer to offer training courses to help them carry out their work properly—and stay independent.

Independence, however, does not mean one-man operation. With increased complexity of equipment will come specialist repair depots owned and operated by franchised dealers, or service technicians.

But they, like the lone operator, will have to work very closely with the manufacturers—and study, study, study!

Power sources for portable equipment

THE EARLIEST METHOD USED to produce electrical energy was through chemical action and, in spite of its greater cost as compared with that produced by rotating machinery, it is going to be with us for a long, long time. Its big feature, of course, is portability and we always think of the chemical cell in relation to hearing aids, transistor radios and now the portable TV set.

Out of the great array of primary cells that were invented in the early days, only the Leclanché has survived and this is in the form of the familiar dry cell. There have been variations of this such as the air-cell that was used with the old 2-volt filament-type tubes but these too have passed away and only the dry cell shown in Figure 1 remains from that era. But to meet new applications and more stringent requirements we find a number of new devices on the market. We hear the terms "energizer" and "activator" and we know that a mercury battery exists but how much do we know of their principles and characteristics?

PRIMARY CELLS

Primary cells are distinguished from the secondary or storage cells by the fact that their chemical action cannot be reversed and so they are not rechargeable. The dry primary cell is only dry in the sense that the electrolyte is in the form of a paste and will not spill.

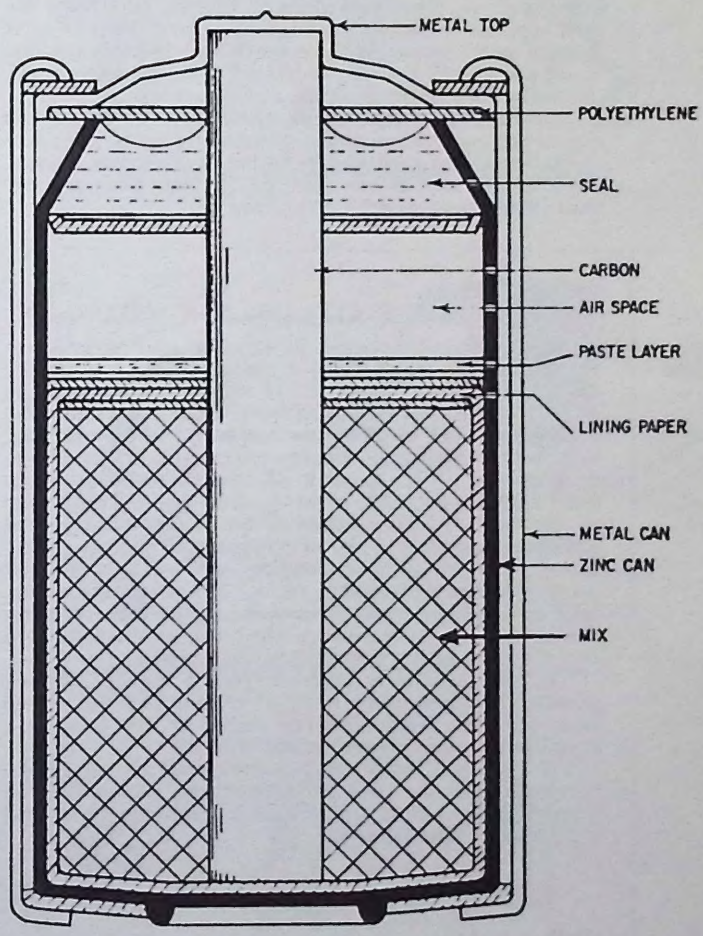
All dry cells produce their electrical energy by oxidizing a metal such as zinc in an electrolytic solution. Referring to Figure 1, the zinc can is the negative terminal and is referred to as an anode. This may seem confusing until we realize that internally the electron flow is from the carbon to the zinc while externally it is from the zinc to the carbon. It should be noted too that the carbon rod takes no part in the chemical action but is just a convenient conductive material.

The paste electrolyte is made of sal ammoniac (ammonium chloride). Manganese dioxide is provided as a depolarizer, providing oxygen to combine with freed hydrogen. Hydrogen appears when current passes through the cell and would otherwise block the passage of the current. The carbon rod is fairly porous so that it serves also as a gas vent.

DRAWBACKS

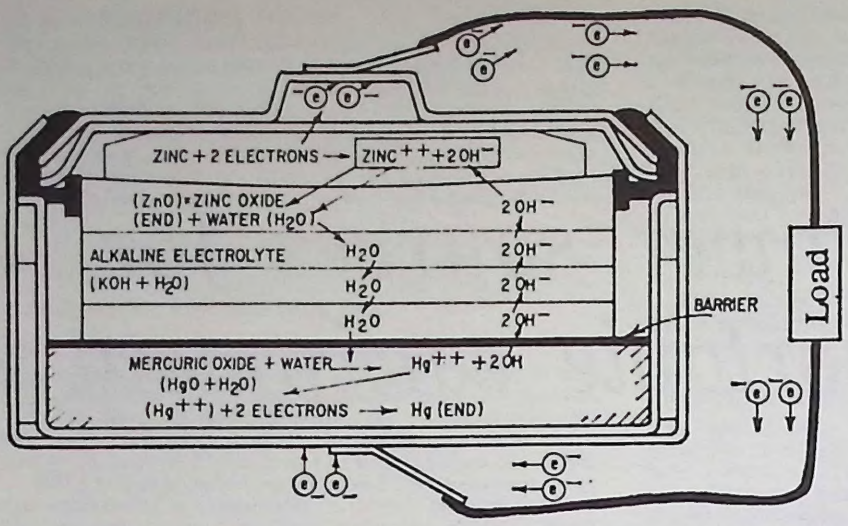
The zinc-carbon cell provides an average of 20-watt hours per pound in most applications but, on heavy loads, it becomes inefficient and provides about 10-watt hours per pound.

The relatively impure low-cost manganese dioxide is the cause of poor shelf life since impurities in the natural ore cause local action that slowly exhausts the cell. However a very pure synthetic product has been developed to provide a more efficient oxygen-bearing material.



The cell requires constant venting to relieve internal pressure but this allows water vapour to escape from the cell at higher temperatures. The result is drying out of the electrolyte and an increase in the internal resistance.

Another weakness of the zinc-carbon cell is that its output drops off steadily, beginning rather early in the discharge cycle. This results because the manganese dioxide gives up only 30 to 50 percent of its oxygen. The manganese dioxide (MnO_2) is rapidly converted to MnO_3, a compound that is much less conductive than the original.



During the last hours of its life, the zinc-carbon cell suffers from oxygen starvation and, since some zinc still remains, the chemical action goes on and hydrogen accumulates. We have all seen the final result at one time or another. Pressure distorts the can so that it becomes wedged in the flashlight or it bursts and the electrolyte spills out to damage the components of a radio receiver. The modern steel-jacketed cell helps prevent such accidents.

Despite these drawbacks, the zinc-carbon cell fills many a need in industry, combining as it does low initial cost and availability in many sizes and shapes. Needless to say, it has been vastly improved since it was introduced nearly 100 years ago.

THE MANGANESE-ALKALINE-ZINC CELL

This cell was developed jointly by Ruben Laboratories and P. R. Mallory Company and a cutaway view is shown in Figure 2. It will deliver from 30 to 40 watt-hours per pound at fairly high rates and good efficiency. The depolarizer is a blend of natural and synthetic manganese dioxide with a small percentage of graphite. The density of the material is made very high by forming it into pellets under many tons of pressure. This improves the conductivity and makes an ample supply of oxygen available. Partly due to the latter, the alkaline cell will not leak or burst if left in a discharge state. The alkaline electrolyte is a 40 percent potassium hydroxide solution pre-saturated with zinc so that the zinc anode will not dissolve when the cell stands unused.

The zinc anode is pressed from a highly purified powder amalgamated with pure mercury to reduce local action. Note that the anode is not used as a container but is placed inside the cell.

To increase anode surface area and therefore the conductivity, the cells are sometimes built with the anode in a gel structure holding the electrolyte and a dispersed zinc powder.

THE MERCURIC-ALKALINE-ZINC CELL

From inquiries we have made it would appear that more technicians are familiar with the mercury cell than with the manganese alkaline and know that it is considered to be the best commercially available dry cell today.

It delivers 45 watt-hours per pound and 6 watt-hours per cubic inch with high efficiency and good voltage regulation. It does not require a rest between loads (to disperse accumulated hydrogen) because oxygen is released so rapidly from the mercuric oxide. Another outstanding feature of these cells is the low internal resistance even in the very small size. Furthermore, whether the load is continuous or interrupted has little effect on the total energy delivered.

For those who are interested in what goes on inside the mercury cell, the story is told by Mallory in Figure 3. Under no load, the voltage of the cell will be the net sum of the electro-chemical reactions of zinc and mercuric oxide with respect to the alkaline electrolyte. The zinc dissolves or ionizes in the electrolyte, leaves electrons behind and gives the zinc anode a negative charge. At the same time, positive charges accumulate at the mercuric oxide cathode.

Under load (as shown) the cell potential forces the electrons at the anode in the direction indicated. This reduction of the anode charge upsets the electro-chemical balance and the zinc again begins to go into solution as zinc ions. At the cathode, the mercuric oxide combines with water and separates into mercury and hydroxyl ions. The latter react with the zinc to form zinc oxide (a white paste often seen around expended flashlight cells) and water. Note that there has been no net loss of water in this system.

The electrons pass through the load, expend their energy and end up on the cathode. The mercury ions capture two electrons each and become free mercury. If an expended cell is broken open, the latter will be seen as globules of mercury in a mass of inert graphite.

These reactions occur through a permeable barrier of paper or porous plastic that passes ions but prevents solid particles from migrating and causing internal shorts.

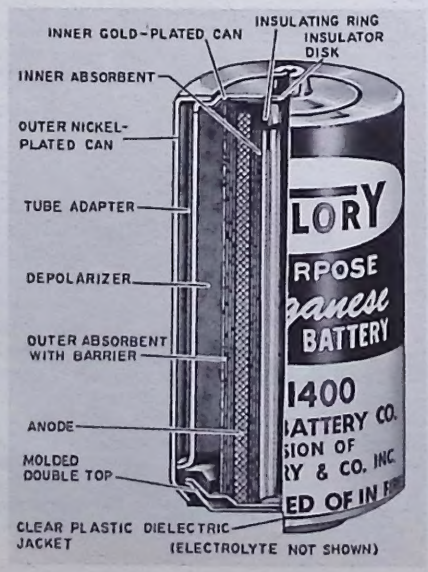
If the foregoing seems complicated, just be happy that we don't have to design them—just use them.

MERCURY CELL CHARACTERISTICS

Part of the high reliability of the mercury cell is due to the plated-steel container. It is not eaten away by chemical action and so does not swell or leak if left on load after complete discharge. (This is also true of the manganese-alkaline system.)

The shelf life of the mercury cell is unusually good. After standing eight years at room temperature, the remaining capacity is 65 to 70%; and after twelve years, 25 to 40%.

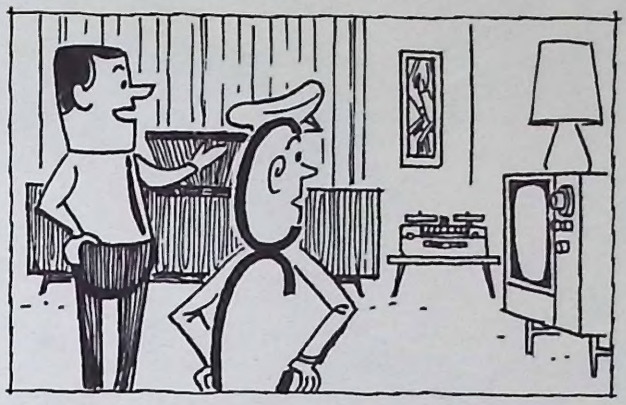
Both mercury and manganese-alkaline cells withstand high temperatures well. At a sustained 120°F. they both show 25% of their room-temperature capacity after a year. Both cells are recommended where 3 to 5 years of delayed service (in normal surroundings) are anticipated.



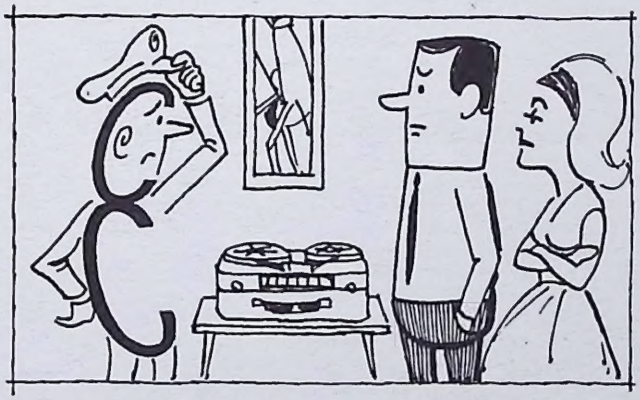
Cathode Charlie

keeping up with the changes

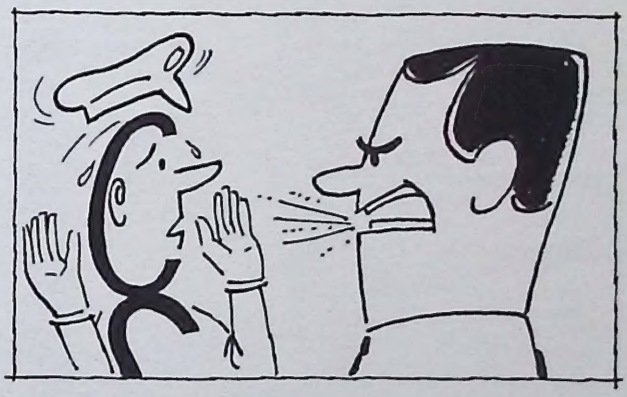
■ So we thought we'd kill three birds with one stone . . . get you in to fix the TV . . .



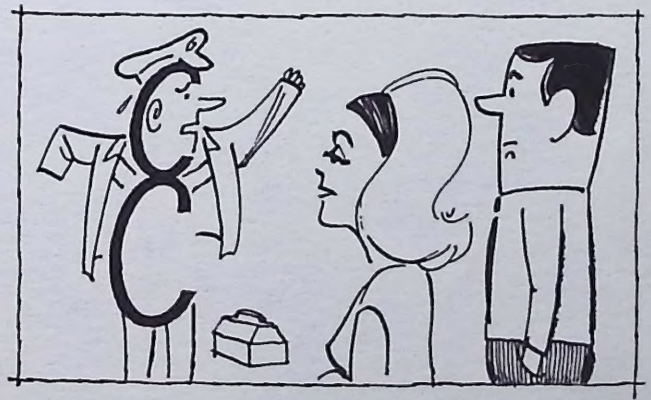
■ . . . and have you take a look at the record player and tape recorder at the same time.



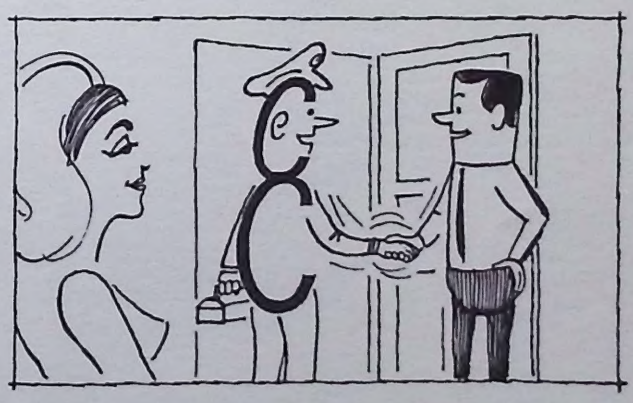
■ Sorry Mr. McConkle! 'Fraid it'll have to go into the repair shop. Tape recorders are a bit out of my line anyway.



■ Thought you guys knew every last thing about electronic thingummies . . .



■ Well, we certainly try, Mr. McConkle, but the research and development boys keep pulling a few steps ahead of us.



■ Thanks very much Mr. McConkle, and you've given me an idea. Next training course on electronics—guess who'll be the first to join?

And the moral of this story is: for today's technician there's no standing still. Every day may bring new developments, but it brings new solutions too. The man who keeps up with the changes is the man who gets ahead.

Letters

TO THE BOOSTER

FROM D. M. Sadovnick,
Vice-president (Public Relations),
Professional Association of Independent Electronicians,
6855a St. Andre, Montreal, Quebec.

. . . I would like to thank you for the stand you have taken towards the advancement of professional ethics in the electronic servicing industry. Particularly thanks and many of them . . . for the article on our association.

To say that we are very pleased, would be an understatement. The reports that we have received from the members at large in the short time (from issue to date) is as you say in French "formidable."

The research done by your Mr. S. Wisdom at our several meetings was most exacting, and as is shown in his final results, well worth the efforts. Of course to the person who wrote the editorial also goes "honourable mention."

In closing, I must once again thank you for all the co-operation that your company has given to our association to date. I am convinced that it will entice all others concerned to work even harder to gain the professional standing that we all deserve.

FROM R. Ward,
Sales Promotion Manager,
Light and Appliances Division,
Philips Appliances Limited.

Dear Mr. Sadovnick:

. . . Our sincere thanks for your letter of Feb. 27th. It is our pleasure to be able to publicize organizations who are trying to achieve ethical practices among technicians. We, in fact, intend to cover similar groups in a comparable manner in future issues.

However, ours is not of course a one sided crusade. We intend to use equal power to help slay any selfishly motivated dragons that may appear. "Professional dignity . . . but with freedom" might well be our battle cry.

Write to us at *The Booster*, and let us know about service hints or promotion methods *you* have found effective. If the editors find them suitable for publication, you'll receive $5.00!

Or send us the beefs you'd like to have aired in front of the manufacturers . . . naturally, we don't pay for these.

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Further copies available in limited numbers upon request.

CBC, CTV UNITE AGAINST COLOUR

The publicly owned Canadian Broadcasting Corp. and the privately owned CTV Television Network Ltd. both voiced opposition to Canada's immediate entry into colour television.

Their position was in direct opposition to that of the set manufacturers, who called on the Board of Broadcast Governors to lift current restrictions on colour as the first step in the orderly development of colourcasting on a national scale within the next two years.

Mr. Spencer W. Caldwell, president of CTV, said that it was important to determine how colour television is to be financed, since experience in the United States has shown that advertisers were reluctant to invest in colour programs or commercials. The only Canadian colour programs available at the moment were travelogues and industrial films and these could not be presented as entertainment in competition with programs received from those United States border stations that transmit colour.

The CBC contend that public funds could be better used to improve black and white programs and to extend the national service to all Canadians.

The Globe and Mail—January 16.

COLOUR BROADCASTING DISTANT

The decision of the Board of Broadcast Governors against introduction of colour television in Canada at this time indicates it will be several years before colour programs will be broadcast in this country.

The BBG also failed to accept a compromise suggestion by the Canadian Broadcasting Corporation that it establish an industry-wide committee to study the problems involved in colour television in Canada.

In its statement, the Board cited as arguments against the new television dimension, the high cost of receivers, lack of wide acceptance in the United States and the scarcity of colour programming.

Home Goods Retailing—Feb. 11.

COLOUR PAY TELEVISION

The Home Entertainment Co., of Santa Monica, Calif. gave the first demonstration of its colour pay television system. Subscribers will pay a $10 deposit; a $1 monthly service charge and fees for hypothetical programs ranging from 15 cents for stock market reports and 25 cents for basic French to $1 for Elvis Presley and a top of $1.50 for "West Side Story." The Salt Lake Tabernacle Choir would be free.

There would be two program channels plus one program preview channel giving prices.

No modification is required for existing sets and programs would be completely unrestricted and "uninhibited" by commercial sponsors.

Advertising Age—December 17.

TV SATURATION IN CANADA

A recent survey by the Television Bureau of Advertising shows saturation of television sets in Canada has reached as high as 97% in some centres. The number of television households in Canada is now over the 4,157,700 mark.

By areas, saturation is 83% in B.C. and the Prairie Provinces, 93% in Quebec, 92% in Ontario and 81% in the Atlantic Provinces.

In Calgary and Sudbury, 97% of homes have television sets; in Regina, Kingston, Trois Rivieres and Moncton, 96% own sets, and Saskatoon, Toronto, Ottawa, Montreal and Saint John show 95% saturation.

Home Goods Retailing—Feb. 11.

HOME TELEVISION TAPE RECORDER

Home tape recording of television programs has come a step closer to reality with the introduction of a system which utilizes slow-speed recording techniques to capture such programs.

The feasibility of a home video tape recorder that records and plays back television programs over present home television sets is said to have been proven by researchers at the Armour Research Foundation of the Illinois Institute of Technology, Chicago.

Eventually, even a low-priced Vidicon camera that tape-records motion pictures for immediate home playback on the television screen also is said to be not too far off.

Home Furnishings Daily—March 27.

PUBLISHED BY ROGERS ELECTRONIC TUBES AND COMPONENTS *Philips Appliances Ltd., 116 Vanderhoof Avenue, Toronto 17, Ontario*